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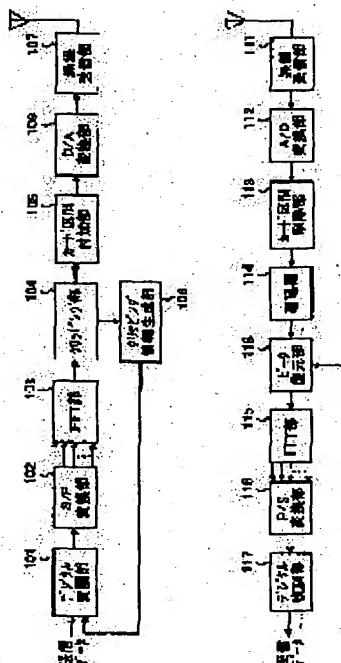
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(54) COMMUNICATION SYSTEM AND COMMUNICATION METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a communication system, where a transmitter side transmits a signal, while its peak voltage is suppressed and a receiver side restores the signal whose peak voltage is suppressed.

SOLUTION: A clipping section 104 samples the difference between an amplitude of a signal and a threshold, outputs the information of the difference together with a time, when the signal exceeds the threshold value to a clipping information generating section 108 and outputs a peak voltage of the transmission signal excess of the threshold level, which is suppressed to the threshold, to a guard period addition section 105. The clipping information generating section 108 generates clipping information on the basis of the difference information and the time, when the transmission signal exceeds the threshold and outputs the clipping information to a digital modulation section 101. A peak restoring section 118 adds a difference between the amplitude of the transmission signal and the threshold to a received signal, when the transmission signal exceeds the threshold on the basis of the clipping information to restores the received signal into a state before the suppression and outputs the result to an FFT section 115.



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CLAIMS

[Claim(s)]

[Claim 1] The communication device characterized by providing the following. A suppression means to oppress the value of the aforementioned amplitude below to a threshold, and to measure the amount of suppression in the time and the aforementioned time which were oppressed when the value of the amplitude of a sending signal exceeds a predetermined threshold. An information generation means to generate the control information which shows the time and the amount of suppression which were oppressed, and the transmitting means which carries out radio transmission of the sending signal after the repressed for an amplitude with the aforementioned suppression means including data and the aforementioned control information.

[Claim 2] a suppression means -- the difference of a sending signal and a threshold -- the communication device according to claim 1 characterized by oppressing a sending signal and measuring the aforementioned amount of suppression by making a value into the amount of suppression

[Claim 3] It is the communication device according to claim 1 characterized by for a suppression means carrying out the multiplication of the factor, oppressing it to a sending signal, and an information generation means generating the control information which shows the time and the factor which were oppressed.

[Claim 4] It is the communication device according to claim 1 characterized by for a suppression means carrying out the multiplication of the weight function, oppressing it to a sending signal, and an information generation means generating the control information which shows the time and the weight function which were oppressed.

[Claim 5] It is the communication device according to claim 1 characterized by for a suppression means carrying out the multiplication of the weight function, oppressing it on the peak portion of a sending signal, and the outskirts of it, and an information generation means generating the control information which shows the time and the weight function which were oppressed.

[Claim 6] A transmitting means is a communication device given in either of a claim 1 to the claims 5 characterized by transmitting after predetermined carries out time maintenance of the sending signal.

[Claim 7] A transmitting means is a communication device given in either of a claim 1 to the claims 5 characterized by transmitting after predetermined carries out time maintenance of the control information.

[Claim 8] The communication device characterized by providing an information extraction means to extract control information from the received signal, and a restoration means to restore a repressed signal based on the aforementioned control information.

[Claim 9] A restoration means is a communication device according to claim 8 characterized by adding the difference of an amplitude to an input signal at an input signal based on the time which took difference based on control information.

[Claim 10] A restoration means is a communication device according to claim 8 characterized by carrying out the multiplication of the factor to an input signal based on the time oppressed from control information.

[Claim 11] A restoration means is a communication device according to claim 8 characterized by carrying out the multiplication of the weight function to an input signal based on the time oppressed from control information.

[Claim 12] A communication device given in either of the claims 8-11 characterized by providing an output means to output after predetermined carries out time maintenance of the received signal.

[Claim 13] A communication device given in either of a claim 8 to the claims 11 characterized by providing a control information output means to output after predetermined carries out time maintenance of the control information.

[Claim 14] Base station equipment characterized by having the communication device of a publication in either of a claim 1 to the claims 13.

[Claim 15] The communication terminal characterized by having the communication device of a publication in either of a claim 1 to the claims 13.

[Claim 16] The correspondence procedure characterized by providing the following. The suppression process which oppresses the value of the aforementioned amplitude below to a threshold, and oppresses and measures the amount of suppression in the time and the aforementioned time which were oppressed when the value of the amplitude of a sending signal exceeds a predetermined threshold. The information generation process which generates the control information which shows the time and the amount of suppression which were oppressed. The transmitting process which carries out radio transmission of the sending signal after the repressed for an amplitude with the aforementioned suppression means including data and the aforementioned control information. The information extraction process of extracting control information from the received signal, and the restoration process which restores a repressed signal based on the aforementioned control information.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the multi-carrier communication device and the peak-power suppression method that especially the OFDM (Orthogonal Frequency Division Multiple) method was applied, about the peak voltage suppression method in a communication device.

[0002]

[Description of the Prior Art] Multi-carrier communication is used for the transmission-and-reception side of mobile station equipments, such as a portable telephone in mobile communication system, and a mobile videophone machine, this mobile station equipment and the base station equipment which performs communication, digital TV broadcast, and digital voice broadcast.

[0003] Drawing 9 is the block diagram showing the composition of the conventional multi-carrier communication device. The multi-carrier communication device 11 shown in drawing 9 equips a transmitting side with the digital modulation section 12, the S/P (Serial/Parallel) transducer 13, and the IFFT (reverse fast Fourier transform) section 14, and the FFT (fast Fourier transform) section 15, the P/S (Parallel/Serial) transducer 16, and the digital recovery section 17 are constituted in preparation for a receiving side.

[0004] In such composition, digital modulation by transmit data is performed in the digital modulation section 12 in a transmitting side according to BPSK (Binariphase Phase Shift Keying) and modulation techniques, such as 16QAM (Quadrature Amplitude Modulation).

[0005] They are the S/P transducer 13, the serial data after this modulation are changed into parallel data (digital symbol), by this parallel data's being the IFFT section 14, and carrying out reverse fast-Fourier-transform processing, are superimposed by the subcarrier from which a phase differs respectively and are outputted as a transmitting OFDM symbol signal with which this continues serially.

[0006] A receiving OFDM symbol signal is the FFT section 15, on the other hand, in a receiving side, each data on which the subcarrier from which a phase differs respectively by carrying out fast-Fourier-transform processing was overlapped is separated, the parallel data after this separation are changed into serial data by the P/S transducer 16, it is the digital recovery section 17, and a digital recovery is carried out and this serial data is outputted.

[0007] Here, in multi-carrier communication, after changing transmit data into parallel data, in order to superimpose and transmit to two or more subcarriers, there is no correlation for every subcarrier. For this reason, when the phase of each subcarrier laps, it will have a very big signal amplitude as an OFDM symbol.

[0008] Thus, by the lap of each subcarrier, when the peak voltage of a signal became high at the time of transmission and this is amplified with amplifier, the peak portion of a signal will be deleted according to the upper limit gain of amplifier.

[0009] Moreover, the multi-code multiplex transmission not only in a multi-carrier but spread-spectrum communication, when pulley coding processing is performed, there is a case where the peak voltage of a sending signal becomes high, plentifully, and the same problem as multi-carrier communication arises.

[0010] In order to prevent this, when large-sized amplifier is used, enlargement of the whole equipment is caused, equipment becomes high by this, and there is a problem that increase of power consumption and the increase in generation of heat will be caused further.

[0011] Here, as a method of oppressing peak voltage, from the former, the upper limit of voltage is set to JP,7-143098,A etc., and the method of cutting the voltage exceeding a upper limit simply is already indicated.

[0012]

[Problem(s) to be Solved by the Invention] However, only by cutting peak voltage, since a signal is distorted and a band is extended, there is a problem that the error rate at the time of reception deteriorates (a transmission

characteristic deteriorates).

[0013] Without making this invention in view of this point, and degrading a transmission characteristic in an easy equipment configuration, by the transmitting side, peak voltage is oppressed, and it transmits, and aims at offering the communication device and correspondence procedure which can restore the signal which oppressed peak voltage by the receiving side on the other hand.

[0014]

[Means for Solving the Problem] A suppression means for the communication device of this invention to oppress the value of the aforementioned amplitude below to a threshold when the value of the amplitude of a sending signal exceeds a predetermined threshold, and to measure the amount of suppression in the time and the aforementioned time which were oppressed, The composition possessing an information generation means to generate the control information which shows the time and the amount of suppression which were oppressed, and the transmitting means which carries out radio transmission of the sending signal after the repressed for an amplitude with the aforementioned suppression means including data and the aforementioned control information is taken.

[0015] the communication device of this invention -- a suppression means -- the difference of a sending signal and a threshold -- a sending signal is oppressed by making a value into the amount of suppression, and the composition which measures the aforementioned amount of suppression is taken

[0016] According to these composition, the peak voltage of a sending signal can be oppressed by making below into a threshold the signal with which peak voltage exceeded the threshold by the transmitting side, transmitting, sampling the difference of the peak voltage and the threshold beyond this threshold, and transmitting this information. By receiving the information on the amplitude of the portion which oppressed the repressed input signal for the portion into which the signal which oppressed peak voltage by the transmitting side was received, and peak voltage exceeded the threshold using peak suppression information, and on the other hand, restoring by the receiving side, based on this information, the signal which oppressed peak voltage can be received and it can restore.

[0017] A suppression means carries out the multiplication of the factor at a sending signal, the communication device of this invention oppresses, and an information generation means takes the composition which generates the control information which shows the time and the factor which were oppressed.

[0018] A suppression means carries out the multiplication of the weight function at a sending signal, the communication device of this invention oppresses, and an information generation means takes the composition which generates the control information which shows the time and the weight function which were oppressed.

[0019] A suppression means carries out the multiplication of the weight function on the peak portion of a sending signal, and the outskirts of it, the communication device of this invention oppresses, and an information generation means takes the composition which generates the control information which shows the time and the weight function which were oppressed.

[0020] When the peak voltage of a sending signal exceeds a threshold by the transmitting side according to these composition The peak voltage of a sending signal is oppressed by multiplying the sending signal of the portion into which peak voltage exceeded the threshold by the weight function, and peak voltage's changing into the signal below a threshold, and transmitting the information about how applying weight. on the other hand, by the receiving side By restoring to it, multiplying the input signal which was able to be multiplied by the weight function by the weight function for the restoration based on load information, the signal which oppressed peak voltage can be received and it can restore. Moreover, unnecessary component generating to band inside and outside can be reduced by performing weighting not only on a peak portion but on the outskirts of it.

[0021] The communication device of this invention takes the composition which transmits a transmitting means after predetermined carries out time maintenance of the sending signal.

[0022] The communication device of this invention takes the composition which transmits a transmitting means after predetermined carries out time maintenance of the control information.

[0023] According to these composition, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this suppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. When peak voltage receives the information in which a repressed signal and peak suppression information were included and restores a signal by the receiving side of this invention on the other hand based on peak suppression information, peak voltage can be oppressed and it can communicate.

[0024] The communication device of this invention takes the composition possessing an information extraction means to extract control information from the received signal, and a restoration means to restore a repressed signal based on the aforementioned control information.

[0025] The communication device of this invention takes the composition which adds a restoration means to an input signal at an input signal based on the time which took difference for the difference of an amplitude based on control

information.

[0026] According to these composition, the peak voltage of a sending signal can be oppressed by making below into a threshold the signal with which peak voltage exceeded the threshold by the transmitting side, transmitting, sampling the difference of the peak voltage and the threshold beyond this threshold, and transmitting this information. By receiving the information on the amplitude of the portion which oppressed the repressed input signal for the portion into which the signal which oppressed peak voltage by the transmitting side was received, and peak voltage exceeded the threshold using peak suppression information, and on the other hand, restoring by the receiving side, based on this information, the signal which oppressed peak voltage can be received and it can restore.

[0027] The communication device of this invention takes the composition which carries out the multiplication of the factor to an input signal based on the time which oppressed the restoration means from control information.

[0028] The communication device of this invention takes the composition which carries out the multiplication of the weight function to an input signal based on the time which oppressed the restoration means from control information.

[0029] When the peak voltage of a sending signal exceeds a threshold by the transmitting side according to these composition The peak voltage of a sending signal is oppressed by multiplying the sending signal of the portion into which peak voltage exceeded the threshold by the weight function, and peak voltage's changing into the signal below a threshold, and transmitting the information about how applying weight. on the other hand, by the receiving side By restoring to it, multiplying the input signal which was able to be multiplied by the weight function by the weight function for the restoration based on load information, the signal which oppressed peak voltage can be received and it can restore.

[0030] The communication device of this invention takes the composition possessing an output means to output after predetermined carries out time maintenance of the received signal.

[0031] The communication device of this invention takes the composition possessing a control information output means to output after predetermined carries out time maintenance of the control information.

[0032] According to these composition, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this suppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. When peak voltage receives the information in which a repressed signal and peak suppression information were included and restores a signal by the receiving side of this invention on the other hand based on peak suppression information, peak voltage can be oppressed and it can communicate.

[0033] The base station equipment of this invention takes the composition which has the communication device of a publication in one of the above.

[0034] The communication terminal of this invention takes the composition which has the communication device of a publication in one of the above.

[0035] According to these composition, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this suppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. When peak voltage receives the information in which a repressed signal and peak suppression information were included and restores a signal by the receiving side of this invention on the other hand based on peak suppression information, peak voltage can be oppressed and it can communicate.

[0036] The suppression process which oppresses the value of the aforementioned amplitude below to a threshold, and oppresses and measures the amount of suppression in the time and the aforementioned time which were oppressed when, as for the correspondence procedure of this invention, the value of the amplitude of a sending signal exceeds a predetermined threshold, The information generation process which generates the control information which shows the time and the amount of suppression which were oppressed, The transmitting process which carries out radio transmission of the sending signal after the repressed for an amplitude, the information extraction process of extracting the signal which received to control information, and the restoration process which restores a repressed signal based on the aforementioned control information were provided with the aforementioned suppression means including data and the aforementioned control information.

[0037] According to this method, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this suppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. When peak voltage receives the information in which a repressed signal and peak suppression information were included and restores a signal by the receiving side of this invention on the other hand based on peak suppression information, peak voltage can be oppressed and it can communicate.

[0038]

[Embodiments of the Invention] The main point of this invention is oppressing the signal with which peak voltage's exceeded the threshold below to a threshold by the transmitting side, transmitting, sampling the time and the amount of oppression which oppressed the peak voltage beyond this threshold further, transmitting this information, receiving the

information on the amplitude of the portion which is a receiving side on the other hand, and was oppressed, and restoring an input signal based on this information.

[0039] (Form 1 of operation) Drawing 1 is drawing showing the composition of the communication device concerning the form 1 of operation of this invention.

[0040] In drawing 1, the digital modulation of (calling it "clipping information" below) is carried out, the information on the difference of the peak voltage of the amplitude of a sending signal and the threshold which were sampled in the transmit data and the clipping section 104 which were inputted is changed into a transmitting symbol, and the digital modulation section 101 outputs it to the S/P transducer 102. In addition, about clipping, it mentions later.

[0041] The S/P transducer 102 carries out serial parallel conversion of the transmitting symbol outputted from the digital modulation section 101, and outputs it to the IFFT section 103.

[0042] The IFFT section 103 carries out the reverse fast Fourier transform of the transmitting symbol outputted from the S/P transducer 102, superimposes data on each subcarrier, and outputs them to the clipping section 104 as a sending signal.

[0043] When the peak voltage of a sending signal exceeds a threshold, the clipping section 104 samples the difference of the size of the amplitude of a portion and threshold beyond the threshold, and outputs clipping information to the clipping information generation section 108 with the time exceeding the threshold. Moreover, among sending signals, peak voltage oppresses peak voltage to a threshold about the signal of the portion beyond the threshold, outputs the clipping section 104 to the guard section adjunct 105, and outputs it to the guard section adjunct 105, without oppressing the signal of the portion which does not exceed a threshold.

[0044] The guard section adjunct 105 inserts the guard section in the sending signal outputted from the clipping section 104, and outputs it to the D/A-conversion section 106.

[0045] The D/A-conversion section 106 carries out digital analogue conversion of the sending signal outputted from the guard section adjunct 105, and outputs it to the radio transmitting section 107.

[0046] The radio transmitting section 107 carries out frequency conversion of the sending signal outputted from the D/A-conversion section 106, and transmits a radio signal.

[0047] The clipping information generation section 108 creates clipping information based on the time exceeding the value which sampled the difference of the size of the amplitude of a portion and threshold beyond the threshold, and the threshold, and outputs it to the digital modulation section 101.

[0048] The radio receive section 111 carries out frequency conversion of the received signal, and outputs it to the A/D-conversion section 112 as an input signal.

[0049] The A/D-conversion section 112 carries out analog to digital conversion of the input signal, and outputs it to the guard section cutout 113.

[0050] After the guard section cutout 113 deletes the guard section from the input signal outputted from the A/D-conversion section 112, it is outputted to the delay machine 114.

[0051] The delay machine 114 outputs the input signal in which data are contained after predetermined time at the peak restoration section 118. Moreover, it outputs to the peak restoration section 118, without delaying the input signal in which oppression information is included.

[0052] The FFT section 115 carries out the fast Fourier transform of the input signal outputted from the peak restoration section 118, changes it into a receiving symbol, and is outputted to the P/S transducer 116.

[0053] The P/S transducer 116 carries out parallel serial conversion of the receiving symbol outputted from the FFT section 115, and outputs it to the digital recovery section 117.

[0054] The digital recovery section 117 restores to the receiving symbol outputted from the P/S transducer 116 to received data. Moreover, clipping information is outputted to the peak restoration section 118 among received data.

[0055] By adding to the input signal of the time exceeding the threshold, it restores to the state before oppressing an input signal, and the peak restoration section 118 outputs the difference of the size of the amplitude of a portion and threshold which exceeded the threshold based on clipping information to the FFT section 115.

[0056] Next, operation of the transmitting side of the communication device concerning the form of this operation is explained. The digital modulation of the transmit data is carried out in the digital modulation section 101, serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103, and it is outputted to the clipping section 104 as a sending signal.

[0057] In the clipping section 104, the bigger portion among the amplitude of a signal than a predetermined threshold is oppressed by the value of a threshold, and the sending signal outputted in the IFFT section 103 is outputted to the guard section adjunct 105. Moreover, the information on the amplitude which sampled the difference of a signal and a threshold with bigger peak voltage than a threshold, and time is outputted to the clipping information generation section 108.

[0058] In the guard section adjunct 105, the guard section is added to the sending signal outputted from the clipping section 104, digital analogue conversion is carried out in the D/A-conversion section 106, and frequency conversion is carried out in the radio transmitting section 107, and it is changed and transmitted to a radio signal.

[0059] Moreover, the difference and time which were sampled in the clipping section 104 are inputted into the clipping information generation section 108, and clipping information is created.

[0060] The digital modulation of the clipping information is inputted and carried out to the digital modulation section 101. Serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103. The value of a threshold oppresses the peak voltage which exceeded the threshold in the peak oppression section 104, the guard section is added in the guard section adjunct 105, digital analogue conversion is carried out in the D/A-conversion section 106, frequency conversion is carried out in the radio transmitting section 107, and it is outputted as a radio signal.

[0061] Next, operation of the receiving side of the communication device concerning the form of this operation is explained.

[0062] In the radio receive section 111, frequency conversion of the radio signal transmitted from the above-mentioned transmitting side is carried out, it is changed into an input signal, analog to digital conversion is carried out in the A/D-conversion section 112, and the guard section is deleted in the guard section cutout 113, and it is outputted to the delay machine 114.

[0063] Since the input signal containing data should pass predetermined time in the delay machine 114, it is outputted to the peak restoration section 118. Moreover, an input signal including clipping information is outputted to the peak restoration section 118, without being delayed in the delay machine 114. By this, it can restore to a signal including clipping information ahead of the signal containing data.

[0064] It is outputted to the FFT section 115, a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, it recovers from the peak restoration section 118 in the digital recovery section 117, and an input signal including clipping information is outputted to the peak restoration section 118 as clipping information.

[0065] In the peak restoration section 118, when the amplitude sampled by the clipping section 104 at the same time based on clipping information is added by the amplitude of an input signal, an input signal has a peak portion restored and is outputted to the FFT section 115.

[0066] In the FFT section 115, the fast Fourier transform of the restored input signal is carried out, parallel serial conversion is carried out in the P/S transducer 116, and it restores to it in the digital recovery section 117.

[0067] Drawing 2 is drawing showing an example of clipping of the sending signal in the form 1 of operation. In drawing 2, a horizontal axis shows the transmitting time of a signal. A vertical axis shows the size of the amplitude of the signal to transmit.

[0068] Drawing 2 (a) shows an example of a sending signal, and drawing 2 (b) is drawing expanded about the portion 201 into which the amplitude of a signal exceeded the threshold among the sending signals of drawing 2 (a).

[0069] When the amplitude of the signal to transmit is larger than a predetermined threshold, a sending signal is outputted with the value of a threshold. Moreover, about a signal with a bigger value than a threshold, difference with a threshold is taken and this sending signal transmits independently the information on the time exceeding the size and threshold. When the amplitude of the signal to transmit is smaller than a predetermined threshold, a signal is outputted without changing an amplitude.

[0070] Since the amplitude of a sending signal is over the threshold in time t1, t2, t3, t4, t5, and t6 in drawing 2 (b), the difference of the amplitude of a signal and a threshold is sampled.

[0071] The difference V1 of an amplitude and a threshold is sampled at time t1. The difference V2 of an amplitude and a threshold is sampled at time t2. The difference V3 of an amplitude and a threshold is sampled at time t3. The difference V4 of an amplitude and a threshold is sampled at time t4. The difference V5 of an amplitude and a threshold is sampled at time t5. The difference V6 of an amplitude and a threshold is sampled at time t6.

[0072] An amplitude, the time t1, t2, t3, t4, t5, and t6 which sampled the difference of a threshold, and the sampled values V1, V2, V3, V4, V5, and V6 are outputted to the clipping information generation section 108. And in the clipping information generation section 108, the clipping information based on time t1, t2, t3, t4, t5, and t6 is created, and it is transmitted through the digital modulation section 101, the S/P transducer 102, the IFFT section 103, the clipping section 104, the guard section adjunct 105, the D/A-conversion section 106, and the radio transmitting section 107.

[0073] Thus, the communication device of the form of this operation can oppress the peak voltage of a sending signal by making below into a threshold the signal with which peak voltage exceeded the threshold by the transmitting side, transmitting, sampling the difference of the peak voltage and the threshold beyond this threshold, and transmitting this

information. By receiving the information on the amplitude of the portion which oppressed the input signal which had the portion into which the signal which oppressed peak voltage by the transmitting side was received, and peak voltage exceeded the threshold using peak oppression information oppressed, and on the other hand, restoring by the receiving side, based on this information, the signal which oppressed peak voltage can be received and it can restore.

[0074] (Form 2 of operation) Drawing 3 is drawing showing the composition of the communication device concerning the form 2 of operation of this invention. However, about the thing used as the same composition as drawing 1, the same number as drawing 1 is attached and detailed explanation is omitted.

[0075] In drawing 3, the reverse fast Fourier transform of the IFFT section 103 is carried out to a transmitting symbol, it superimposes data on each subcarrier, and outputs them to the load section 301 as a sending signal.

[0076] The load section 301 carries out the multiplication of the weight function to a sending signal about the portion into which peak voltage exceeds a threshold in a sending signal, and its circumference, oppresses the size of an amplitude below to a threshold, and outputs it to the guard section adjunct 105. Moreover, the information on how to apply the time which applied weight to the signal, and weight (henceforth "load information") is outputted to the oppression information generation section 302.

[0077] The oppression information generation section 302 creates a load information signal based on the information outputted from the load section 301, and outputs it to the digital modulation section 101.

[0078] Next, operation of the transmitting side of the communication device concerning the form of this operation is explained.

[0079] A sending signal can apply a weight function on the bigger portion among the amplitude of a signal than a predetermined threshold, and the outskirts of it in the load section 301, and is outputted to the guard section adjunct 105. Moreover, load information is outputted to the oppression information generation section 302.

[0080] Moreover, load information is inputted into the oppression information generation section 302, and a load information signal is created.

[0081] The digital modulation of the load information signal is inputted and carried out to the digital modulation section 101. Serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103. The multiplication of the weight function is carried out to peak voltage about the signal of a portion with which peak voltage exceeded the threshold in the load section 301. The guard section is added in the guard section adjunct 105, digital analogue conversion is carried out in the D/A-conversion section 106, frequency conversion is carried out in the radio transmitting section 107, and it is outputted as a radio signal.

[0082] Next, operation of the receiving side of the communication device concerning the form of this operation is explained. In the radio receive section 111, frequency conversion of the radio signal transmitted from the transmitting side is carried out, it is changed into an input signal, analog to digital conversion is carried out in the A/D-conversion section 112, and the guard section is deleted in the guard section cutout 113, and it is outputted to the delay machine 114.

[0083] Since the input signal containing data should pass predetermined time in the delay machine 114, it is outputted to the peak restoration section 311. Moreover, an input signal including load information is outputted to the peak restoration section 311, without being delayed in the delay machine 114. By this, a signal including load information can be more nearly first recovered from the signal containing data.

[0084] It is outputted to the FFT section 115, a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, it recovers from the peak restoration section 311 in the digital recovery section 117, and an input signal including load information is outputted to the peak restoration section 311 as load information.

[0085] By the ability applying the weight function for restoring to a repressed peak based on load information, an input signal has a repressed peak restored, and is outputted to the FFT section 115, a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, and it restores to it in the digital recovery section 117.

[0086] Drawing 4 is drawing showing an example of weighting of the sending signal in the gestalt 2 of operation. In drawing 4, a horizontal axis shows the transmitting time of a signal. A vertical axis shows the size of the amplitude of the signal to transmit.

[0087] Drawing 4 (a) shows an example of a sending signal. Drawing 4 (b) shows the sending signal which expanded the portion 401. Drawing 4 (c) shows an example of the weight function which carries out multiplication to a sending signal.

[0088] Next, the example of weighting of a sending signal is explained.

[0089] When the amplitude of the signal to transmit is larger than a predetermined threshold, the multiplication of the sending signal is carried out in the weight function shown in drawing 4 (c) about the portion beyond the threshold, and

its circumference.

[0090] By applying low weight to the big portion 401 of the peak of a sending signal, a sending signal is outputted as a signal of an amplitude smaller than a threshold. By performing weighting also including the circumference of a peak portion, information, such as, which can reduce generating of the unnecessary component to band inside and outside and a kind of weight function, time which carried out multiplication, or timing, is transmitted.

[0091] When the amplitude of a sending signal is smaller than a threshold, a sending signal is outputted without carrying out the multiplication of the weight function to an amplitude.

[0092] Thus, when the communication device of the gestalt of this operation is a transmitting side and the peak voltage of a sending signal exceeds a threshold, the peak voltage of a sending signal is oppressed by multiplying the sending signal of the portion into which peak voltage exceeded the threshold by the weight function, and peak voltage's changing into the signal below a threshold, and transmitting the information about how applying weight, on the other hand, by the receiving side. By restoring to it, multiplying the input signal which was able to be multiplied by the weight function by the weight function for the restoration based on load information, the signal which oppressed peak voltage can be received and it can restore.

[0093] (Gestalt 3 of operation) Drawing 5 is drawing showing the composition of the communication device concerning the gestalt 3 of operation of this invention. However, about the thing used as the same composition as drawing 1, the same number as drawing 1 is attached and detailed explanation is omitted.

[0094] In drawing 5, when the peak voltage of a sending signal exceeds a threshold, the peak suppression section 501 samples the difference of the size of the amplitude of a portion and threshold beyond the threshold, and outputs it to the clipping information generation section 108 with the time exceeding the threshold. Moreover, among sending signals, peak voltage oppresses peak voltage to a threshold about the signal of the portion beyond the threshold, outputs the peak suppression section 501 to the guard section adjunct 105, and outputs it to the guard section adjunct 105, without oppressing the signal of the portion which does not exceed a threshold.

[0095] The buffer section 502 holds a sending signal during predetermined time, and outputs a sending signal to the guard section adjunct 105 after that.

[0096] The buffer section 511 holds peak suppression information during predetermined time, and outputs peak suppression information to the peak restoration section 118 after that.

[0097] Next, operation of the transmitting side of the communication device concerning the gestalt of this operation is explained.

[0098] The digital modulation of the transmit data is carried out in the digital modulation section 101, serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103, and it is outputted to the peak suppression section 501 as a sending signal.

[0099] In the peak suppression section 501, about the bigger portion among the amplitude of a signal than a predetermined threshold, a sending signal is oppressed by the threshold in an amplitude and outputted to the buffer section 502. Moreover, a differential signal is outputted to the clipping information generation section 108.

[0100] A differential signal is inputted into the clipping information generation section 108, and peak suppression information is created.

[0101] The digital modulation of the peak suppression information is inputted and carried out to the digital modulation section 101. Serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103. In the peak suppression section 501 the bigger portion among the amplitude of a signal than a predetermined threshold It is oppressed by the value of a threshold and outputted to the guard section adjunct 105, and the guard section is added in the guard section adjunct 105, digital analogue conversion is carried out in the D/A-conversion section 106, frequency conversion is carried out in the radio transmitting section 107, and it is outputted as a radio signal.

[0102] After peak suppression information is transmitted, from the buffer section 502, a sending signal is outputted to the guard section adjunct 105, the guard section is added to it in the guard section adjunct 105, digital analogue conversion is carried out in the D/A-conversion section 106, and frequency conversion is carried out in the radio transmitting section 107, and it is changed and transmitted to a radio signal.

[0103] Next, operation of the receiving side of the communication device concerning the gestalt of this operation is explained.

[0104] In the radio receive section 111, frequency conversion of the radio signal transmitted from the transmitting side is carried out, and analog to digital conversion is carried out in the A/D-conversion section 112, it is changed into an input signal, and is outputted to the guard section cutout 113.

[0105] An input signal is deleted in the guard section in the guard section cutout 113, and is outputted to the peak restoration section 118.

[0106] An input signal is sent in order of the input signal which includes peak suppression information from the above-mentioned transmitting side, and the input signal containing data.

[0107] An input signal including peak suppression information is outputted without carrying out signal processing in the peak restoration section 118, and a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, it gets over in the digital recovery section 117, and it is outputted to the buffer section 511 as peak suppression information. If the input signal containing data is inputted into the peak restoration section 118, peak suppression information will be outputted to the peak restoration section 118 from the buffer section 511.

[0108] The input signal containing data is outputted to the peak restoration section 118.

[0109] In the peak suppression section 118, an input signal has a repressed peak restored based on peak suppression information, and is outputted to the FFT section 115, a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, and it restores to it in the digital recovery section 117.

[0110] Thus, by transmitting the information on the difference of the peak voltage of a signal, and a threshold about the signal with which it is a transmitting side and peak voltage exceeded the threshold, by oppressing the peak voltage of a sending signal and restoring the signal with which it is a receiving side on the other hand, and peak voltage exceeded the threshold using peak suppression information, the communication device of the gestalt of this operation can receive the signal which oppressed peak voltage, and can be restored.

[0111] (Gestalt 4 of operation) Drawing 6 is drawing showing the composition of the communication device concerning the gestalt 4 of operation of this invention. However, about the thing used as the same composition as drawing 1, the same number as drawing 1 is attached and detailed explanation is omitted.

[0112] In drawing 6, the modulation section 601 modulates clipping information and outputs it to the diffusion section 602.

[0113] The diffusion section 602 uses for and diffuses a sign to the modulated clipping information, and outputs it to the D/A-conversion section 603.

[0114] Digital analogue conversion of the D/A-conversion section 603 is carried out, and it outputs to the radio transmitting section 604.

[0115] The radio transmitting section 604 carries out frequency conversion of the clipping information, and transmits.

[0116] The radio receive section 611 carries out frequency conversion of the input signal, and outputs it to the A/D-conversion section 612.

[0117] The A/D-conversion section 612 carries out analog to digital conversion of the input signal outputted in the radio receive section 611, and outputs it to the back-diffusion-of-gas section 613.

[0118] The back-diffusion-of-gas section 613 uses a sign for the input signal outputted from the A/D-conversion section 612, performs back-diffusion of gas, and outputs it to the recovery section 612.

[0119] The recovery section 614 restores to the input signal outputted from the back-diffusion-of-gas section 613 to received data.

[0120] Next, operation of the transmitting side of the communication device concerning the gestalt of this operation is explained.

[0121] The digital modulation of the transmit data is carried out in the digital modulation section 101, serial parallel conversion is carried out in the S/P transducer 102, and a reverse fast Fourier transform is carried out in the IFFT section 103, and it is outputted to the clipping section 104 as a sending signal.

[0122] A sending signal oppresses a bigger amplitude among the amplitude of a signal than a predetermined threshold to the value of a threshold in the clipping section 104, and is outputted to the guard section adjunct 105. Moreover, the difference of a bigger amplitude and a bigger threshold than a threshold is outputted to the clipping information generation section 108 as a differential signal.

[0123] In the guard section adjunct 105, the guard section is added to a sending signal, digital analogue conversion is carried out in the D/A-conversion section 106, and frequency conversion is carried out in the radio transmitting section 107, and it is changed and transmitted to a radio signal.

[0124] A differential signal is inputted into the clipping information generation section 108, and clipping information is created.

[0125] In the modulation section 601, it becomes irregular, peak suppression information is diffused using a sign in the diffusion section 602, digital analogue conversion is carried out in the D/A-conversion section 603, and frequency conversion is carried out in the radio transmitting section 604, and it is outputted as a radio signal.

[0126] Next, operation of the receiving side of the communication device concerning the gestalt of this operation is explained.

[0127] In the radio receive section 111, frequency conversion of the radio signal transmitted from the transmitting side is carried out, it is changed into an input signal, analog to digital conversion is carried out in the A/D-conversion section 112, and the guard section is deleted in the guard section cutout 113, and it is outputted to the peak restoration section 118.

[0128] On the other hand, frequency conversion is carried out in the radio receive section 611, analog to digital conversion is carried out in the A/D-conversion section 612, back-diffusion of gas is carried out using a sign in the back-diffusion-of-gas section 613, it gets over in the recovery section 614, and a radio signal including clipping information is outputted to the peak restoration section 118 as peak suppression information, after being received.

[0129] In the peak restoration section 118, an input signal has a repressed peak restored based on clipping information, a fast Fourier transform is carried out in the FFT section 115, parallel serial conversion is carried out in the P/S transducer 116, and it restores to it in the digital recovery section 117.

[0130] Thus, by transmitting this information for the signal with which it is a transmitting side and peak voltage exceeded the threshold, by oppressing the peak voltage of a sending signal, and receiving and acquiring the clipping information which is a receiving side on the other hand, and was transmitted using another modulation technique, the communication device of the gestalt of this operation can receive the signal which oppressed peak voltage, and can be restored.

[0131] In addition, it can become irregular using the same modulation technique as data, and clipping information can also be transmitted and received using another frequency.

[0132] (Gestalt 5 of operation) Drawing 7 is drawing showing the composition of the communication device concerning the gestalt 5 of operation of this invention. However, about the thing used as the same composition as drawing 1, the same number as drawing 1 is attached and detailed explanation is omitted.

[0133] In drawing 7, the S/P transducer 102 carries out serial parallel conversion of the transmit data outputted from the digital modulation section 101, and outputs it to the diffusion section 701.

[0134] The diffusion section 701 diffuses the transmit data outputted from the S/P transducer 102 with a sign different, respectively, and outputs it to the synthetic section 702.

[0135] The synthetic section 702 compounds the transmit data outputted from the diffusion section 701, and outputs it to the peak suppression section 703 as a sending signal.

[0136] The peak suppression section 703 performs peak suppression about the portion which exceeds a threshold among sending signals, and outputs it to the radio transmitting section 107. Moreover, the information about peak suppression is outputted to the peak suppression information generation section 704.

[0137] The peak suppression information generation section 704 creates suppression data from the information about peak suppression, and outputs them to the modulation section 705.

[0138] The modulation section 705 modulates suppression data and outputs them to the radio transmitting section 706. The radio transmitting section 706 carries out frequency conversion of the modulated suppression data, and transmits as a radio signal.

[0139] The radio receive section 711 carries out frequency conversion of the radio signal containing the received suppression data, and outputs it to the recovery section 712 as an input signal.

[0140] The recovery section 712 restores to an input signal, takes out suppression data, and outputs them to the peak restoration section 713.

[0141] The radio receive section 111 carries out frequency conversion of the radio signal containing the received data, considers as an input signal, and is outputted to the peak restoration section 713.

[0142] The peak restoration section 713 restores the repressed portion of the input signal which contains data based on suppression information, and outputs it to the back-diffusion-of-gas section 714.

[0143] The back-diffusion-of-gas section 714 performs back-diffusion of gas to received data using a sign, and outputs the acquired symbol train to the P/S transducer 116.

[0144] The P/S transducer 116 carries out parallel serial conversion of the symbol train, changes it into serial data, and is outputted to the digital recovery section 117.

[0145] The digital recovery section 117 restores to serial data, and outputs it as received data.

[0146] Next, operation of the transmitting side of the communication device concerning the gestalt of this operation is explained.

[0147] In the digital modulation section 101, it becomes irregular, serial parallel conversion is carried out in the S/P transducer 102, it is spread using a sign which is different in the diffusion section 701, respectively, each symbol is compounded in the synthetic section 702, and transmit data is outputted to the peak suppression section 703 as a transmitting symbol.

[0148] In the peak suppression section 703, a transmitting symbol has peak voltage oppressed and is outputted to the

radio transmitting section 107 as a sending signal. Moreover, peak suppression information is outputted to the peak suppression information generation section 704.

[0149] Frequency conversion of the sending signal is carried out in the radio transmitting section 107, and it is transmitted as a radio signal.

[0150] On the other hand, peak suppression information is changed into a peak suppression information symbol in the peak suppression information generation section 704, and is outputted to the modulation section 705.

[0151] In the modulation section 705, it becomes irregular, and frequency conversion of the peak suppression information symbol is carried out in the radio transmitting section 706, and it is transmitted as a radio signal.

[0152] Next, operation of the receiving side of the communication device concerning the gestalt of this operation is explained.

[0153] In the radio receive section 111, frequency conversion of the radio signal transmitted from the transmitting side is carried out, it is changed into an input signal, and is outputted to the peak restoration section 713.

[0154] On the other hand, frequency conversion is carried out in the radio receive section 711, it gets over in the recovery section 712, and a radio signal including peak suppression information is outputted to the peak restoration section 713 as peak suppression information, after being received.

[0155] In the peak restoration section 713, an input signal has a repressed peak restored based on peak suppression information, back-diffusion of gas is carried out in the back-diffusion-of-gas section 714, parallel serial conversion is carried out in the P/S transducer 116, and it restores to it in the digital recovery section 117.

[0156] Thus, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this suppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. When peak voltage receives the information in which a repressed signal and peak suppression information were included and restores a signal by the receiving side of this invention on the other hand based on peak suppression information, peak voltage can be oppressed and it can communicate.

[0157] (Gestalt 6 of operation) Drawing 8 is drawing showing the composition of the communication device concerning the gestalt 6 of operation of this invention. However, about the thing used as the same composition as drawing 1, the same number as drawing 1 is attached and detailed explanation is omitted.

[0158] In drawing 8, the digital modulation section 101 carries out the digital modulation of the inputted transmit data, changes it into a transmitting symbol, and is outputted to an adder unit 801.

[0159] An adder unit 801 adds the transmitting symbol outputted from the digital modulation section 101, and the amendment signal outputted from the multiplication section 804, and outputs it to the clipping section 805 and the delay section 802.

[0160] After the delay section 802 holds a transmitting symbol in predetermined time, it is outputted to the multiplication section 804.

[0161] The circuit presumption section 803 presumes the influence in radio from received data, and outputs the correction factor for creating the signal which negates the influence of the delay wave in a radio circuit.

[0162] The multiplication section 804 carries out the multiplication of the correction factor outputted from the circuit presumption section 803 to the transmitting symbol outputted from the delay section 802, and outputs it to an adder unit 801.

[0163] When the peak voltage of a sending signal exceeds a threshold, the clipping section 805 samples the difference of the size of the amplitude of a portion and threshold beyond the threshold, and outputs clipping information to the clipping information generation section 806 with the time exceeding the threshold. Moreover, among sending signals, peak voltage oppresses peak voltage to a threshold about the signal of the portion beyond the threshold, outputs the clipping section 805 to the radio transmitting section, and outputs it to the radio transmitting section 808, without oppressing the signal of the portion which does not exceed a threshold.

[0164] The radio transmitting section 107 changes a sending signal into a radio frequency, and transmits.

[0165] The clipping information generation section 806 creates clipping information based on the time exceeding the value which sampled the difference of the size of the amplitude of a portion and threshold beyond the threshold, and the threshold, and outputs it to the modulation section 807.

[0166] The modulation section 807 modulates clipping information and outputs it to the radio transmitting section 808.

[0167] The radio transmitting section 808 changes clipping information into a radio frequency, and transmits.

[0168] The radio receive section 811 receives the clipping information transmitted from the radio transmitting section 808, performs frequency conversion, and outputs it to the recovery section 812.

[0169] The recovery section 812 restores to the clipping information outputted from the radio receive section 811, and outputs it to the peak restoration section 814.

[0170] The radio receive section 813 receives the signal transmitted from the radio transmitting section 107, performs frequency conversion, and outputs it to the peak restoration section 814.

[0171] By adding to the input signal of the time exceeding the threshold, it restores to the state before oppressing an input signal, and the peak restoration section 814 outputs the difference of the size of the amplitude of a portion and threshold which exceeded the threshold based on clipping information to the digital recovery section 117 as a receiving symbol.

[0172] The digital recovery section 117 restores to a receiving symbol, and outputs it as received data.

[0173] Next, operation of the transmitting side of the communication device concerning the gestalt of this operation is explained.

[0174] In the digital modulation section 101, it becomes irregular, and transmit data is outputted to an adder unit 801 as a transmitting symbol.

[0175] A transmitting symbol is added with an amendment symbol in an adder unit 801, and is outputted to the clipping section 805 and the delay section 802.

[0176] The transmitting symbol outputted to the delay section 802 is outputted after predetermined time at the multiplication section 804.

[0177] An amendment factor is created in the circuit presumption section 803 based on received data, and is outputted to the multiplication section 804.

[0178] In the multiplication section 804, the multiplication of the transmitting symbol outputted from the delay section 802 is carried out in an amendment factor, and it is outputted to an adder unit 801.

[0179] In the clipping section 805, the bigger portion among the amplitude of a signal than a predetermined threshold is oppressed by the value of a threshold, and the transmitting symbol outputted from the adder unit 801 is outputted to the radio transmitting section 107. Moreover, the information on the amplitude which sampled the difference of a signal and a threshold with bigger peak voltage than a threshold, and time is outputted to the clipping information generation section 806.

[0180] In the radio transmitting section 107, frequency conversion of the transmitting symbol outputted to the radio transmitting section 107 is carried out, and it is transmitted as a radio signal.

[0181] Clipping information is created based on the difference of the signal outputted from the clipping section 805 in the clipping information generation section 806, and the information on time, and is outputted to the modulation section 807. In the modulation section 807, it becomes irregular, and clipping information is outputted to the radio transmitting section 808, is changed into a radio frequency in the radio transmitting section 808, and is transmitted as a radio signal.

[0182] Next, operation of the receiving side of the communication device concerning the form of this operation is explained.

[0183] In the radio receive section 811, frequency conversion of the radio signal transmitted from the radio transmitting section 808 is carried out, and it is outputted to the recovery section 812, and it gets over in the recovery section 812, and it is outputted to the peak restoration section 814 as clipping information.

[0184] In the radio receive section 813, frequency conversion of the radio signal transmitted from the radio transmitting section 107 is carried out, and it is outputted to the peak restoration section 814 as an input signal.

[0185] An input signal has the amplitude of the peak voltage which surpassed the predetermined threshold based on clipping information restored, is outputted to the digital recovery section 101, and it gets over in the digital recovery section 101, and it is outputted as received data.

[0186] Thus, by oppressing the peak voltage of a sending signal, transmitting and transmitting the information about this oppression, the transmitting side of this invention can oppress peak voltage, and can transmit data. On the other hand, by the receiving side of this invention, by receiving the signal with which peak voltage was oppressed, and the information in which peak oppression information was included, and restoring a signal based on peak oppression information, peak voltage can be oppressed and it can communicate.

[0187] [Effect of the Invention] Since the signal which could oppress the peak voltage of a signal, could transmit and oppressed peak voltage by the receiving side on the other hand can be restored according to this invention as explained above, degradation of a transmission characteristic can be prevented by the easy equipment configuration.

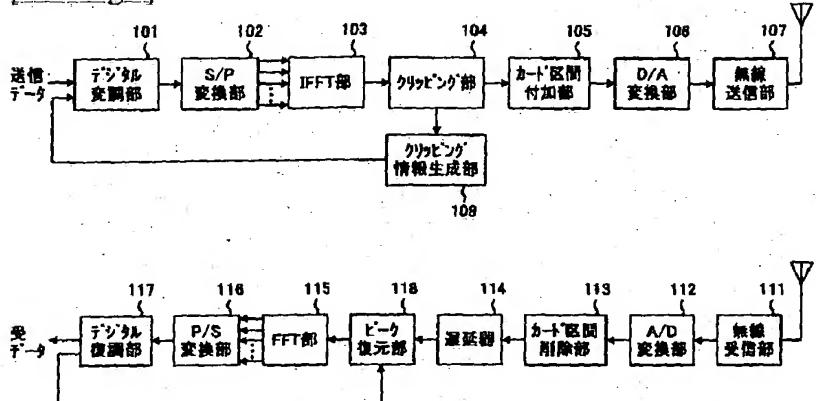
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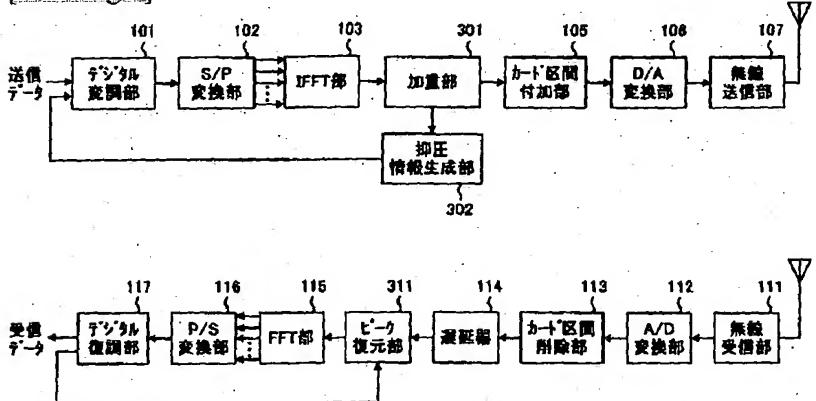
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2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

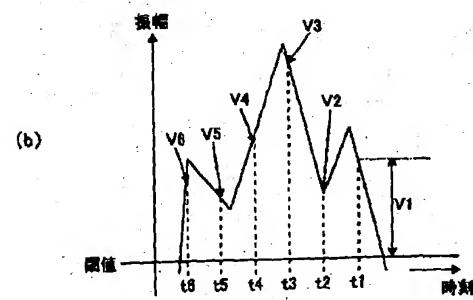
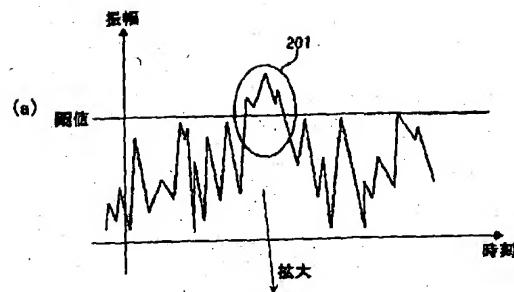
[Drawing 1]



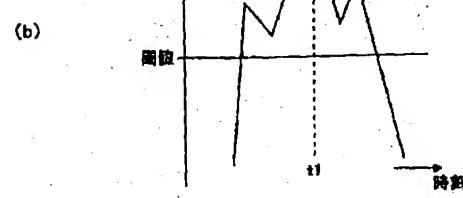
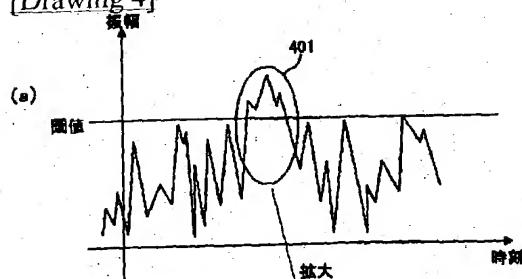
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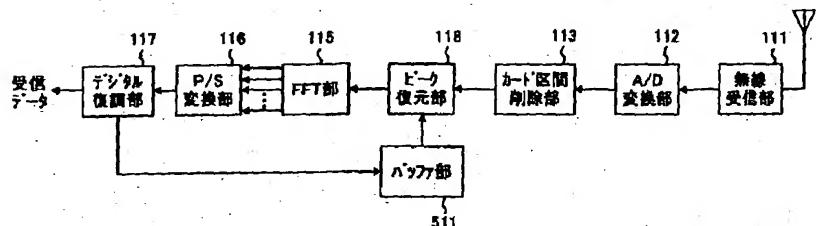
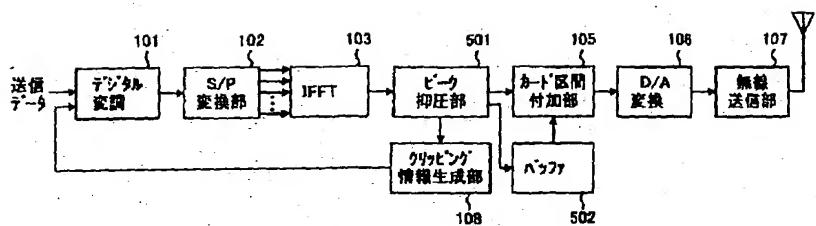
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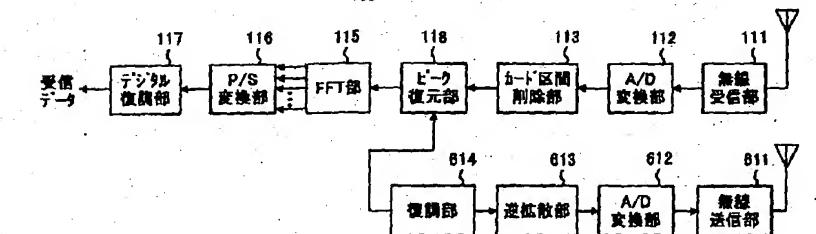
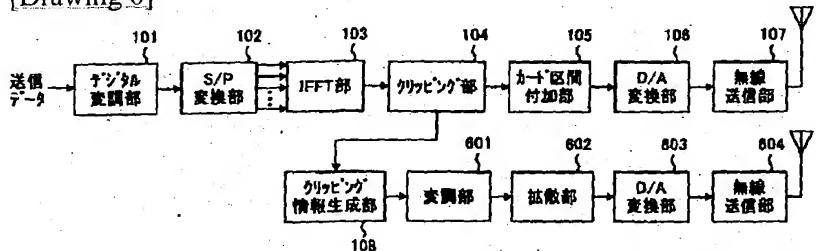
[Drawing 4]



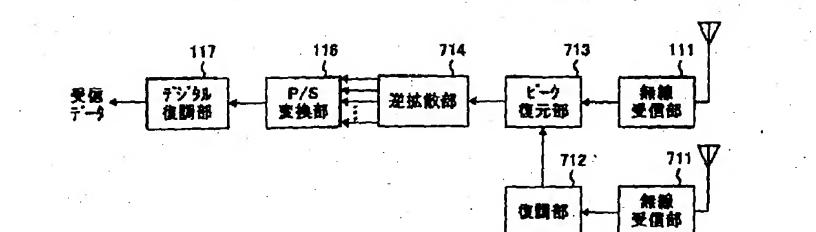
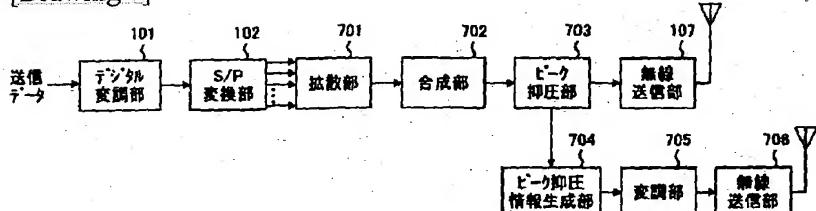
[Drawing 5]



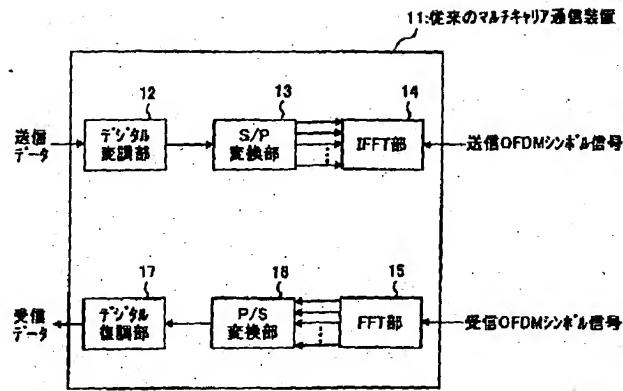
[Drawing 6]



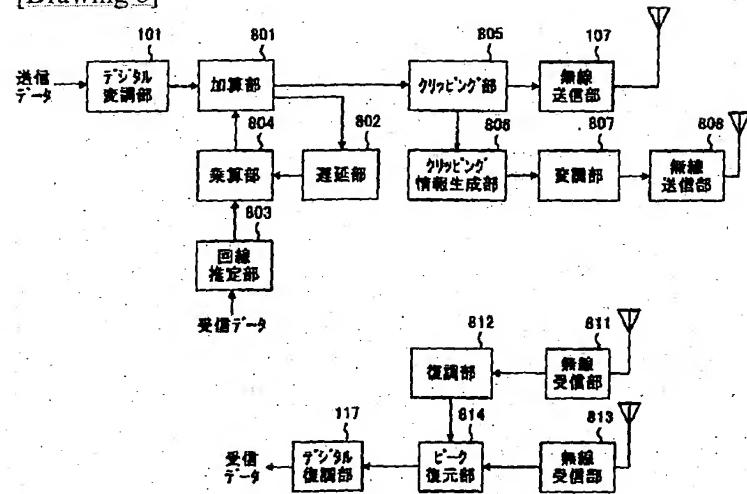
[Drawing 7]



[Drawing 9]



[Drawing 8]



[Translation done.]